Flame Retardant Alternatives

Proprietary I: Organic phosphate ester

Hazard Review

Proprietary I: Organic phosphate ester
Existing Data Summary Table – Human Health Endpoints

✓= Endpoint characterized by existing data * = Data available but not adequate ✘ = Endpoint not applicable

As noted in this key, a check mark indicates that an endpoint was adequately characterized by existing studies. It does not indicate a positive or negative result for that particular endpoint.

Acute Toxicity	
Oral	✓
Dermal	✓
Inhalation	✓
Eye irritation	✓
Dermal irritation	✓
Skin sensitization	✓
Subchronic Toxicity	
28-Day oral	
90-Day oral	
Combined repeated dose with reproduction/ developmental toxicity screen	
21/28-Day dermal	
90-Day dermal	
90-Day inhalation	
Reproductive Toxicity	
Reproduction/ developmental toxicity screen	✓
Combined repeated dose with reproduction/ developmental toxicity screen	✓
Reproduction and fertility effects	✓

Developmental Toxicity	
Reproduction/ developmental toxicity screen	✓
Combined repeated dose with reproduction/ developmental toxicity screen	
Prenatal developmental	
Chronic Toxicity	
Chronic toxicity (two species)	
Combined chronic toxicity/ carcinogenicity	
Carcinogenicity	
Carcinogenicity (rat and mouse)	
Combined chronic toxicity/ carcinogenicity	

Neurotoxicity	
Acute and 28-day delayed neurotoxicity of organophosphorus substances (hen)	
Neurotoxicity screening battery (adult)	
Developmental neurotoxicity	
Additional neurotoxicity studies	
Immunotoxicity	
Immunotoxicity	
Genotoxicity	
Gene mutation in vitro	✓
Gene mutation in vivo	
Chromosomal aberrations in vitro	✓
Chromosomal aberrations in vivo	✓
DNA damage and repair	
Other	

Proprietary I: Organic phosphate ester
Existing Data Summary Table – Properties, Fate, and Ecotoxicity

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As noted in this key, a check mark indicates that an endpoint was adequately characterized by existing studies. It does not indicate a positive or negative result for that particular endpoint.

P/Chem Properties	
Water solubility	✓
Octanol/water partition coefficient	
Oxidation/reduction	
Melting point	
Boiling point	✓
Vapor pressure	
Odor	
Oxidation/reduction chemical incompatibility	
Flammability	
Explosivity	
Corrosion characteristics	
pH	✘
UV/visible absorption	
Viscosity	
Density/relative density/bulk density	
Dissociation constant in water	✘
Henry's Law constant	

Environmental Fate	
Bioconcentration	
Fish	✓
Daphnids	
Green algae	
Oysters	
Earthworms	
Metabolism in fish	
Degradation and Transport	
Photolysis, atmosphere	
Photolysis, water	
Photolysis in soil	
Aerobic biodegradation	✓
Anaerobic biodegradation	
Porous pot test	
Pyrolysis	
Hydrolysis as a function of pH	✓
Sediment/water biodegradation	
Soil biodegradation w/ product identification	
Indirect photolysis in water	
Sediment/soil adsorption/desorption	

Ecotoxicity	
Aquatic Toxicity	
Fish acute LC50	✓
Daphnia acute EC50	
Mysid shrimp acute LC50	
Green algae EC50, NOAEC, LOAEC	
Fish chronic NOAEC, LOAEC	
Daphnia chronic NOAEC, LOAEC	
Mysid shrimp chronic NOAEC, LOAEC	
Terrestrial Organism Toxicity	
Bird LD50 (two species)	
Bird LC50 (two species)	
Bird reproduction	
Earthworm subchronic EC50, LC50, NOAEC, LOAEC	

Chemical Identity

Proprietary I: Organic phosphate ester
CAS
MF
MW
SMILES

Human Health Endpoints

ACUTE TOXICITY

Acute Oral Toxicity (OPPTS Harmonized Guideline 870.1100; OECD Guidelines 425, 420, 423, 401)

Conclusion:

The available acute oral toxicity data were judged adequate to meet the endpoint.

Basis for Conclusion:

A confidential acute oral toxicity study was submitted that reported an LD50 greater than 5 g/kg for rats. These data allow this endpoint to be adequately characterized.

Acute Dermal Toxicity (OPPTS Harmonized Guideline 870.1200; OECD Guideline 402)

Conclusion:

The available acute dermal toxicity data were judged adequate to meet the endpoint.

Basis for Conclusion:

A confidential acute dermal toxicity study was submitted that reported an LD50 greater than 5 g/kg for rats. These data allow this endpoint to be adequately characterized.

Acute Inhalation Toxicity (OPPTS Harmonized Guideline 870.1300 (OECD Guideline 403)

Conclusion:

The available acute inhalation toxicity data were judged adequate to meet the endpoint.

Basis for conclusion:

A confidential acute inhalation toxicity study was submitted that reported an LC50 greater than 1.55 mg/L for rats. These data allow this endpoint to be adequately characterized.

Acute Eye Irritation (OPPTS Harmonized Guideline 870.2400; OECD Guideline 405)

Conclusion:

The available acute eye irritation data were judged adequate to meet the endpoint.

Basis for Conclusion:

A confidential study was submitted that reported mild and transient eye irritation in rabbits. These data allow this endpoint to be adequately characterized.

Acute Dermal Irritation (OPPTS Harmonized Guideline 870.2500; OECD Guideline 404)

Conclusion:

The available acute dermal irritation data were judged adequate to meet the endpoint.

Basis for Conclusion:

A confidential study was submitted that reported negative results for skin irritation in rabbits. These data allow this endpoint to be adequately characterized.

Skin Sensitization (OPPTS Harmonized Guideline 870.2600; OECD Guideline 429)

Conclusion:

The available skin sensitization data were judged adequate to meet the endpoint.

Basis for Conclusion:

A confidential study was submitted that reported negative results for skin sensitization in guinea pigs. These data allow this endpoint to be adequately characterized.

SUBCHRONIC TOXICITY

Conclusion:

No available subchronic toxicity data.

Basis for Conclusion:

No pertinent studies were located that addressed the subchronic toxicity endpoints in the guidelines listed below.

Subchronic Oral Toxicity (28-day, 90-day, or combined with reproductive/developmental)

- **Repeated Dose 28-Day Oral Toxicity in Rodents (OPPTS Harmonized Guideline 870.3050; OECD Guideline 407)**
- **90-Day Oral Toxicity in Rodents (OPPTS Harmonized Guideline 870.3100; OECD Guideline 408)**,
- **Combined Repeated Dose Toxicity Study with the Reproduction/Developmental Toxicity Screening Test (OPPTS Harmonized Guideline 870.3650; OECD Guideline 422), respectively**.

Subchronic Dermal Toxicity (21/28-day or 90-day).

- **21/28-Day Dermal Toxicity (OPPTS Harmonized Guideline 870.3200 (OECD Guideline 410)**
- **90-Day Dermal Toxicity (OPPTS Harmonized Guideline 870.3250; OECD Guideline 411)**

Subchronic Inhalation Toxicity (90 day)

- **90-Day Inhalation Toxicity (OPPTS Harmonized Guideline 870.3465; OECD Guideline 413)**

REPRODUCTIVE TOXICITY

Conclusion:

The available reproductive toxicity data were judged adequate to meet the endpoint.

Basis for Conclusion:

A confidential reproductive/developmental screening assay satisfies the requirements for this endpoint.

- **Reproduction/Developmental Toxicity Screening (OPPTS Harmonized Guideline 870.3550; OECD Guideline 421)**

A confidential reproductive/developmental screening study was submitted that found no reproductive effects at doses up to 1000 mg/kg/day.

No other pertinent studies were located that addressed reproductive toxicity endpoints in the guidelines listed below.

- **Combined Repeated Dose Toxicity Study with the Reproduction/Developmental Toxicity Screening Test (OPPTS Harmonized Guideline 870.3650; OECD Guideline 422)**
- **Reproduction and Fertility Effects (OPPTS Harmonized Guideline 870.3800; OECD Guideline 416)**

DEVELOPMENTAL TOXICITY

Conclusion:

The available developmental toxicity data were judged adequate to meet the endpoint.

Basis for Conclusion:

A confidential reproductive/developmental screening assay satisfies the requirements for this endpoint.

- **Prenatal Developmental Toxicity Study (OPPTS Harmonized Guideline 870.3700; OECD Guideline 414)**
- **Combined Repeated Dose Toxicity Study with the Reproduction/Developmental Toxicity Screening Test (OPPTS Harmonized Guideline 870.3650; OECD Guideline 422)**
- **Reproduction/Developmental Toxicity Screening (OPPTS Harmonized Guideline 870.3550; OECD Guideline 421)**

A confidential reproductive/developmental screening study was submitted that found no developmental effects at doses up to 1000 mg/kg/day.

CHRONIC TOXICITY

Conclusion:

No available chronic toxicity data.

Basis for Conclusion:

No pertinent studies were located that addressed the chronic toxicity endpoints in the guidelines listed below.

- **Chronic Toxicity (OPPTS Harmonized Guideline 870.4100; OECD Guideline 452)**
- **Combined Chronic Toxicity/Carcinogenicity (OPPTS Harmonized Guideline 870.4300; OECD Guideline 453)**

CARCINOGENICITY

Conclusion:

No available carcinogenicity data.

Basis for Conclusion:

No pertinent studies were located that addressed the carcinogenicity endpoints in the guidelines listed below.

- **Carcinogenicity (OPPTS Harmonized Guideline 870.4200; OECD Guideline 451)**
- **Combined Chronic Toxicity/Carcinogenicity (OPPTS Harmonized Guideline 870.4300; OECD Guideline 453)**

NEUROTOXICITY

Conclusion:

No available neurotoxicity data.

Basis for Conclusion:

No neurotoxicity studies were located that addressed the endpoints in the guidelines listed below.

Delayed Neurotoxicity
- **Acute and 28-Day Delayed Neurotoxicity of Organophosphorus Substances (OPPTS Harmonized Guideline 870.6100; OECD Guideline 418, 419)**

Neurotoxicity (Adult)
- **Neurotoxicity Screening Battery (OPPTS Harmonized Guideline 870.6200; OECD Guideline 424)**

Developmental Neurotoxicity
- **Developmental Neurotoxicity: Developmental Neurotoxicity Study (OPPTS Harmonized Guideline 870.6300)**

IMMUNOTOXICITY

Conclusion:

No available immunotoxicity data.

Basis for Conclusion:

No immunotoxicity studies were located that addressed the endpoints in the guidelines listed below.

- **Immunotoxicity (OPPTS Harmonized Guideline 870.7800)**

GENOTOXICITY

Conclusion:

The available genotoxicity data were judged adequate to meet the endpoint.

Basis for Conclusion:

Adequate studies are available for gene mutations in bacterial and mammalian cells *in vitro*, and chromosomal aberrations *in vitro* and for micronucleus formation *in vivo.* All tests yielded negative results for genotoxicity.

Gene Mutation in Vitro:

- **Bacterial Reverse Mutation test (OPPTS Harmonized Guideline 870.5100; OECDGuideline 471)**

Confidential studies were submitted that found negative results for gene mutation in *Salmonella* and *Escherichia coli.*

- **In vitro Mammalian Cell Gene Mutation Test (OPPTS Harmonized Guideline 870.5300; OECD Guideline 476)**

A confidential study was submitted that found negative results for gene mutation in cultured mouse lymphoma cells.

Chromosomal Aberrations in Vitro:

- **In Vitro Mammalian Chromosome Aberration Test (OPPTS Harmonized Guideline 870.5375)**

A confidential study was submitted that reported negative results for an *in vitro* chromosomal aberrations assay.

Chromosomal Aberrations in Vivo:

- **Mammalian erythrocyte micronucleus test (OPPTS Harmonized Guideline 870.5395)**

A confidential study was submitted that reported negative results for micronucleus formation in mice exposed by intraperitoneal injection.

No studies were located that were relevant to the categories below.

Gene Mutation in Vivo
DNA Damage and Repair

Ecotoxicity

Acute Toxicity to Aquatic Organisms

Conclusion:

The available data for the acute toxicity endpoint for fish were judged adequate to meet this endpoint. The currently available data for the acute toxicity endpoints for aquatic invertebrates or algae were judged inadequate to meet the endpoint.

Basis for Conclusion:

A confidential study was submitted that reported a freshwater fish 96-hour LC50 = 0.205 mg/L. These data were judged adequately to meet this endpoint. A confidential study was submitted that reported a freshwater daphnid 48-hour LC50 > 0.846 mg/L. These data were judged inadequate to meet this endpoint.

No other pertinent acute toxicity studies with fish, aquatic invertebrates, or algae were located that addressed the endpoints in the guidelines listed below.

- **Acute Toxicity to Freshwater and Marine Fish (OPPTS Harmonized Guideline 850.1075; OECD Guideline 203)**
- **Acute Toxicity to Freshwater Invertebrates (OPPTS Harmonized Guideline 850.1010; OECD Guideline 202)**
- **Acute Toxicity to Marine/Estuarine Invertebrates (OPPTS Harmonized Guideline 850.1035)**
- **Algal Toxicity (OPPTS Harmonized Guideline 850.5400; OECD Guideline 201)**

Chronic Toxicity to Aquatic Organisms

Conclusion:

The available chronic toxicity data for fish and aquatic invertebrates were judged inadequate to meet the endpoints.

Basis for Conclusion:

A confidential chronic toxicity study was submitted that reported a fish LOEC of 0.088 mg/L, based on reduced larval survival and growth. These data were judged in adequate to meet this endpoint. A confidential chronic toxicity study was submitted that reported a daphnid LOEC of 0.147 mg/L. These data were judged inadequate to meet this endpoint.

No other pertinent chronic toxicity studies with fish or aquatic invertebrates were located that addressed the endpoints in the guidelines listed below.

- **Chronic Toxicity to Freshwater and Marine Fish (OPPTS Harmonized Guideline 850.1400; OECD Guideline 210)**
- **Chronic Toxicity to Freshwater Invertebrates (OPPTS Harmonized Guideline 850.1300; OECD Guideline 211)**
- **Chronic Toxicity to Marine/Estuarine Invertebrates (OPPTS Harmonized Guideline 850.1350)**

Acute and Subchronic Toxicity to Terrestrial Organisms

Conclusion:

No available acute and subchronic toxicity data for terrestrial organisms.

Basis for Conclusion:

No pertinent acute oral, acute dietary, or reproductive toxicity studies with birds and no subchronic toxicity studies with earthworms were located that addressed the endpoints in the guidelines listed below.

- **Acute Oral Toxicity in Birds (OPPTS Harmonized Guideline 850.2100)**
- **Acute Dietary Toxicity in Birds (OPPTS Harmonized Guideline 850.2200; OECD Guideline 205)**
- **Reproductive Toxicity in Birds (OPPTS Harmonized Guideline 850.2300; OECD Guideline 206)**
- **Earthworm Subchronic Toxicity (OPPTS Harmonized Guideline 850.6200; OECD Guideline 207)**

Physical/Chemical Properties

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CAS
MF
MW
SMILES

Water Solubility (mg/L):

Conclusion:

The available water solubility data are adequate.

Basis for Conclusion:

A confidential guideline study indicating that the water solubility of Proprietary I is 0.8 mg/L was submitted..

Log K_{ow}: No data

Oxidation/Reduction: No data

Melting Point: No data

Boiling Point:

Conclusion:

The available boiling point data are adequate.

Basis for Conclusion:

A confidential guideline study indicating that the boiling point of Proprietary I is >300 degrees C at 760 mm Hg was submitted.

Vapor Pressure (torr): No data

Odor: No data

Oxidation/Reduction Chemical Incompatibility: No data

Flammability: No data

Explosivity: No data

Corrosion Characteristics: No data

pH: It is anticipated that the pH for this compound will be not applicable because the functional groups present are not expected to affect the pH of an aqueous solution.

UV/VIS Absorption: No data

Viscosity: No data

Density/Relative Density/Bulk Density: No data

Dissociation Constant in Water: It is anticipated that the dissociation constant for this compound will be not applicable because the functional groups present are not expected to dissociate.

Henry's Law Constant: No data

Environmental Fate

Bioconcentration

Fish:

Conclusion:

The available bioconcentration data are adequate.

Basis for Conclusion:

A confidential guideline study indicating that the bioconcentration factor of Proprietary I is 245 was submitted.

Daphnids: No data

Green Algae: No data

Oysters: No data

Earthworms: No data

Fish Metabolism: No data

Degradation and Transport

Photolysis in the Atmosphere: No data

Photolysis in Water: No data

Photolysis in Soil: No data

Aerobic Biodegradation:

Conclusion:

The available aerobic biodegradation data are adequate.

Basis for Conclusion:

Submitted confidential guideline studies indicated that Proprietary I underwent 2.3% degradation after 28 days in the MITI-II test and 30% removal in 28 days (52% removal in 140 days) in a closed bottle test.

Anaerobic Biodegradation: No data

Porous Pot Test: No data

Pyrolysis: No data

Hydrolysis as a Function of pH:

Conclusion:

The available hydrolysis data are adequate.

Basis for Conclusion:

A confidential guideline study was submitted and indicated that Proprietary I had a half-life at pH 9 and 25 degrees C of 20 days.

Sediment/Water Biodegradation: No data

Soil Biodegradation with Product Identification: No data

Indirect Photolysis in Water: No data

Sediment/Soil Adsorption/Desorption: No data